SUMMARY

POTENTIAL IMPACTS ON PUBLIC HEALTH OF INDUSTRIAL PIG FARMS IN THE REGIONAL COUNTY MUNICIPALITY LE HAUT-SAINT-LAURENT

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LIST OF ABBREVIATIONS

BAPE	Bureau d'audiences publiques sur l'environnement (office of public hearings on the environment)
HAAB	Facultative heterotrophic aerobic and anaerobic bacteria
GSUS	Geological Survey of the United States
IARC	International Agency for Research on Cancer
CLSC	Centre local des services communautaires (local community service centre)
Coalition	Coalition rurale du Haut-Saint-Laurent
VOC	Volatile organic compounds
CSE	Comité de santé environnementale du Québec (environmental health committee of Quebec)
DSP	Direction de la santé publique (public health department)
DSPM	Direction de la santé publique de la Montérégie (Montérégie public health department)
Elgin	Municipality of Elgin
EPA	Environmental Protection Agency in the United States
FPPQ	Fédération des producteurs de porcs du Québec (Quebec pork producers federation)
Godmanchester	Municipality of Godmanchester
Ha	hectare
Huntingdon	Town of Huntingdon
MAMM	Ministère des Affaires municipales et de la Métropole
MAPAQ	Ministère de l'Agriculture, des Pêcheries et de l'Alimentation du Québec
MEF	Ministère de l'Environnement et de la Faune
MENV	Ministère de l'Environnement
MetHbie	Methemoglobinemia
MSSS	Ministère de la Santé et des Services sociaux
WHO	World Health Organization
Ormstown	Municipality of Ormstown

PAEF	Plan agroenvironnemental de fertilisation (agro-environmental fertilization plan)
RCES	Règlement sur le captage des eaux souterraines (regulation on groundwater collection)
RCI	Règlement de contrôle intérimaire (interim control regulation)
RCM	Regional county municipality
REA	Règlement sur les exploitations agricoles (regulation on agricultural operations)
RQEP	Règlement sur la qualité de l'eau potable au Québec (regulation on the quality of drinking water in Quebec)
RRPOA	Règlement sur la réduction de la pollution d'origine agricole (regulation on the reduction of pollution caused by agriculture)
RRSSSM	Régie régionale de la santé et des services sociaux de la Montérégie
Saint-Anicet	Municipality of Saint-Anicet
SAR	Schéma d'aménagement révisé (revised development plan)
SCABRIC	Société de conservation et d'aménagement du bassin de la rivière Châteauguay (society to preserve and develop the Chateauguay river basin)
a.u.	Animal unit
CFU	Colony forming units
NU	Nephelometric units

SUMMARY

POTENTIAL IMPACTS ON PUBLIC HEALTH OF INDUSTRIAL PIG FARMS IN THE REGIONAL COUNTY MUNICIPALITY LE HAUT-SAINT-LAURENT

Background

Announced in the summer of 2001, the introduction of industrial pig farms in the regional county municipality (RCM) Le Haut-Saint-Laurent raised a great deal of public concern in regard to the potential impacts on the environment, public health and socio-economic life. Three producers obtained certificates of authorization from the ministère de l'Environnement (MENV) permitting the construction of pig production facilities by virtue of the *Environment Quality Act*. These establishments are located in three neighbouring municipalities and include one maternity, two nurseries and one finishing facility, representing a total of approximately 900 animal units (a.u.).

In the autumn of 2001, several requests were submitted to the Direction de la santé publique de la Montérégie (DSPM) for an assessment of the impacts on public health of the introduction of these industrial pig farms. These requests had been adopted by resolution and forwarded by the Municipality of Elgin (Elgin), the Board of Directors of the Huntingdon CLSC, the Council of the RCM Le Haut-Saint-Laurent and the Municipality of Godmanchester (Godmanchester). At the time, the DSPM took steps to access information concerning the said projects, but it was only in the autumn of 2002 that it actually acquired access to the significant information on this issue.

This document presents the DSPM's assessment of the potential impacts on public health of the introduction of these industrial pig farms. All potential problems affecting public health have been considered: the contamination of surface water, groundwater and air as well as psychosocial aspects.

Scope and Limits of the Report

This health risk assessment of the risks to health focuses specifically on the three industrial pig farms introduced in the RCM Le Haut-Saint-Laurent. The introduction of other industrial pig farms in the sub-region could modify this notice.

It should be noted that the three projects have received their certificates of authorization, which means that they conform to current regulations. These projects go even farther than certain standards due to commitments made by the producers (phosphorus standard phase II, type and separation distances for manure spreading). In addition, these projects have been developed in an RCM where the municipalities have not registered manure surpluses and where there are practically no pig farms, although there are other animal productions, particularly bovine.

In spite of these facts, through the above-mentioned organizations, the population requested that an assessment be made of the impacts of these projects on public health. As certain representatives have indicated, the population has doubts about the efficacy of the protection provided by current regulations, due to the basis on which they were drawn up and, even if they were drawn up correctly, because of the difficulties involved in ensuring they are respected.

The Government has organized public hearings on pig production in Quebec to better measure the impacts associated with this type of production and to identify solutions applicable for the entire province. Several questions raised here could possibly be answered.

In spite of research carried out to analyse risks associated with these projects, certain essential information is not available, including the difficulty in predicting the specific contribution of the three industrial pig farms within all the sources of contamination affecting watercourses, the lack of specific information on the vulnerability of the groundwater, and limited scientific knowledge on certain topics. This affects the certainty of several conclusions, which means that this risk assessment must be considered qualitative rather than quantitative.

For these reasons, the DSPM will not determine whether or not these projects are acceptable. For each aspect covered (the contamination of surface water, groundwater and air, and psychosocial aspects), the assessment indicates the potential or real problems which merit particular attention and proposes recommendations designed to protect public health.

This document has been submitted to the members of a committee established to discuss and propose solutions for this local problem. This committee groups representatives from the principal departments involved : MENV, the ministère de l'Agriculture, des Pêcheries et de l'Alimentation du Québec (MAPAQ) and the ministère de la Santé et des Services sociaux. This report represents the position of the DSPM, which is not necessarily shared on all points by the other members of the committee.

Methods

To carry out this assessment, the DSPM reviewed the scientific documentation and consulted resource persons and experts. It carried out a survey among citizens living around the planned production buildings and land on which the liquid manure will be spread, to gather information on the characteristics of their wells, the separation distances from the spreading areas and the citizens' perceptions. The pertinent environmental and sanitary data available in the zone concerned and elsewhere in Quebec was also researched.

Assessment of the Risks Associated with Contamination of Surface Water

Local players have raised the possibility that the introduction of industrial pig farms will affect the quality of surface water and drinking water produced by the Town of Huntingdon (Huntingdon). In assessing this risk, there are two determining factors : the additional load of contamination that these projects represent in regard to surface water, beyond the loads

caused by other agricultural activities and sources of contamination (septic tanks, ...) already in place, and the capacity of the water treatment plant in Huntingdon to eliminate this contamination.

The additional load that these projects represent cannot currently be quantified. Nevertheless, it is probably low compared to the contamination already present. The fact that it will join other sources of contamination will make it difficult to estimate its impact. In addition, the degree to which the treatment plant removes micro-organisms is not precisely known (this requires a relatively complex verification) and its conformity to recent standards set by the *Règlement sur la qualité de l'eau potable* (RQEP) has not been verified.

Nevertheless, the risk to public health can, to a great extent, be estimated by assessing the protection currently provided by the Huntingdon water treatment plant, particularly during critical periods. This can be carried out by examining various indicators of the quality of water produced by the plant under different situations.

This plant uses a " conventional " treatment process which includes a series of steps from filtration to disinfection. This process appears to provide good basic protection against the risk of infection; however, the true effectiveness of the plant can vary depending on factors such as the load of contamination received and the operating conditions.

Concentrations of fecal coliforms measured in the Trout and Chateauguay rivers allow us to estimate that, on the average, the degree of contamination of raw water by *Giardia* sp. (a chlorine-resistant parasite) is low to moderate. The turbidity of the water exiting each filter is generally maintained below 0.1 nephelometric units (NU), which allows us to conclude that this plant is probably quite effective in eliminating parasites.

It is clear that, apart from the introduction of the industrial pig farms, the risk of infection is particularly high during periods of thaw or heavy rain. This is explained by the fact that the plant must treat large quantities of water of a poor quality, since it is loaded with organic and inorganic matter as well as micro-organisms due to leaching and erosion of the land. An increased risk of gastroenteritis could occur during these periods depending on the filtration plant's capacity to deal with a sudden and major deterioration in the water quality. According to the data gathered at the plant, the turbidity of the water treated during such situations does not exceed 0.12 NU at each filter, in spite of a significant increase in the turbidity of the raw water (passing from an average of 1.0 or 2.0 to over 100 NU). This indicates that the effectiveness of the filtration does not seem to be compromised during these critical periods. On the other hand, a significant increase in the concentration of ammoniacal nitrogen, probably secondary to agricultural waste, could occur during periods of thaw, thereby reducing the quality of the disinfection by chlorine. It should be noted that filtration is more determining than disinfection in ensuring protection against the risk of infection by parasites. Nevertheless, we cannot exclude a residual risk during these periods, in view of the difficulty of determining the net effect of the complex interaction between these multiple factors.

In short, an increased risk of gastroenteritis could occur during periods of thaw or heavy rain, due to the sudden and significant deterioration in the quality of the water. The data available on the quality of water produced by the Huntingdon treatment plant indicates that the effectiveness of this plant does not seem to be compromised during these critical periods. Additional expertise will be required to assess this aspect fully. Situations involving swelling waters and heavy rain have already occurred for several years and it is not likely that these three industrial pig farms would change the current situation.

According to our analysis, the risks to public health associated with other types of surface water contaminants, that is minerals, herbicides and chlorination by-products do not seem to be of much concern.

RECOMMENDATIONS

- ◊ In view of the fact that contaminants leach from fields during thaws and heavy rains, the frequency of these incidents in the territory concerned, and the possibility that the additional manure spreading related to the arrival of the industrial pig farms or any other type of production will increase the risk of infection during these incidents, it appears prudent to recommend that spreading be avoided in flood zones. This recommendation is also valid for any other type of animal production carried out in this territory. To this effect, an up-date of flood zone mapping should be performed by the RCM.

- ◊ For the same reasons, it would be prudent to limit spreading along other water courses. A larger protection band than the one currently set out in the regulations, that is greater than 3 metres, should be established. It should be noted that a municipality may, by regulation, define an appropriate protection band bordering waterways (Article 30, *Règlement sur les exploitations agricoles* [REA]).

- ◊ We also recommend that the Town of Huntingdon should have a firm of specialized engineers verify the conformity of its water treatment plant with all the RQEP standards and ensure the implementation of any corrections necessary. Ideally, the degree of removal of parasites should also be verified. Taking samples of raw water during critical periods could provide information useful to managing the production of drinking water during these periods.

- ◊ The monitoring of the quality of water in the Trout and Chateauguay rivers performed by MENV should allow estimates to be made of the impacts of agricultural activities in general, and pig production in particular, on these rivers. Monitoring surface water should allow the possible impacts of agricultural activities to be detected more rapidly than that of the groundwater.

- ◊ The current sources of contamination for the Trout and Chateauguay rivers must be more clearly identified. The *comité de bassin de la rivière Châteauguay* could contribute to this task and propose an action plan designed to reduce this contamination.

ASSESSMENT OF RISKS ASSOCIATED WITH THE CONTAMINATION OF GROUNDWATER

There are many factors and complex interactions involved in contamination of groundwater. Under certain conditions, contaminants can migrate farther in groundwater than the separation distances (30 m) provided in the *Règlement sur le captage des eaux souterraines* (RCES) designed to protect wells. The application of fixed separation distances, although practical, cannot be considered a universal answer to protect groundwater. Ideally, a specific assessment of the vulnerability of the water table must be carried out in each zone where mass-rearing is introduced. In this case, the lack of data on the quality of the groundwater in the sectors under study which would enable the impact of current agricultural activities to be assessed and the lack of data on the characteristics of the water table and its vulnerability do not allow an estimate to be made of the extent of the risk of contamination. We are limited to revealing the factors which could attenuate or aggravate the risk of contamination and identifying the residences where wells could be most at risk.

On one hand, certain environmental factors or agricultural practices lead us to believe that the risk of contaminating the groundwater and wells in the sectors under study could be low.

- ◊ According to MENV, the three sites where livestock and liquid manure storage structures will be erected respect current regulations concerning separation distances (wells, water supply systems) and the liquid manure storage structures are presumed to be impervious.

- ◊ The distance of most of the wells, covered by the DSPM survey, from the boundaries of the fields which will receive the liquid manure is greater than the Quebec standard of 30 metres; five wells would be at a lesser distance (visual assessment).

- ◊ One producer has agreed he will not spread manure less than 300 metres from dwellings.

- ◊ The new REA, based on production and follow-up of the *Plan agroenvironnemental de fertilisation* (PAEF) should, in principle, limit the risk of contamination. The producers' respect of their PAEF should also limit the amount of nitrogen and phosphate contaminants and micro-organisms in the environment. Two of the three producers have agreed to respect phase II of the phosphorus standard that offers more protection than that required at the time the requests for certificates of authorization were made. In both cases, the producers will be required to respect this commitment unless they request a modification.

- ◊ Due to the fine texture of the materials (clay, silt) in two sectors where industrial pig farms will be introduced (Elgin, the Municipality of Ormstown [Ormstown]), the vulnerability of the groundwater to contamination is assessed at 2 on a vulnerability scale in which 1 represents low and 4 represents high.

- ◊ The commitment of one promoter to avoid spreading in the flood zone of the Trout River will limit the risk of contaminants contained in the liquid pig manure being dispersed into the environment.

On the other hand, certain environmental factors or agricultural practices could increase this risk of contamination.

◊ The vulnerability of the groundwater to contamination in one of the sectors where a swine production facility will be introduced (Godmanchester) is considered to be high (4 on a vulnerability scale of 1 to 4) due to the permeability of the loose material (sand, gravel). A dry disposal site is currently being operated in this highly permeable unit which could, potentially, contribute to contamination of the groundwater.

◊ Frequent episodes of heavy rainfalls have been reported over the past few years (particularly in May, June and July) in the territory under study. The Chateauguay River watershed is at risk of flooding throughout the year. Spreading of liquid manure in flood zones could contribute to contaminate the environment. Wells that are poorly constructed or protected, located in the flood zone could contribute to the migration of contaminants in the groundwater. In fact, wells dug in flood zones represent a certain level of risk, whether or not there is animal production nearby.

◊ In view of the lack of precision concerning the areas where the liquid manure will be spread by the Ormstown producer, we cannot estimate the risk of contamination for the municipal and institutional networks in this municipality. However, regular monitoring performed as part of the RQEP offers a degree of protection. According to certain provisions of the new RCES, the municipality must assess the vulnerability of groundwater used to supply wells and define appropriate protection areas.

According to the DSPM's survey of property owners located close to the fields where liquid manure will be spread, some fifteen private wells could be at higher risk of contamination due to their characteristics (surface wells, shallow artesian wells [under 9 metres]), or their distance from the fields in question (less than 30 metres from fields which will receive liquid manure, surrounded by corn fields where liquid manure will be spread, or located on or near a vulnerable geological unit). Other criteria related to the quality of the wells (age, protection) may also affect the level of risk for these wells.

RECOMMENDATIONS

◊ Agreements should be drawn up between the producers and municipalities to standardize the three projects and ensure uniformity in spreading practices by having the producers agree not to spread manure in flood zones. This would guarantee a uniform level of protection for the population and the environment. This type of agreement should, in fact, apply to all types of animal production.

◊ The producers must present the municipalities with an up-date of the location of fields on which they will spread the liquid manure so that the wells that are vulnerable to contamination can be identified.

◊ Wells estimated to be less than 30 metres from cultivated fields on which liquid manure will be spread must be identified by the municipalities, the producers and the citizens,

using appropriate visual markers, and specific measures must be taken to ensure the protection of these wells.

◊ In view of the uncertainty surrounding the vulnerability of the water table, we recommend that an environmental follow-up (microbiological, nitrates) be conducted in the wells considered to be most at risk (the wells of the three producers must also be monitored, since they are obviously most at risk of contamination) and a more detailed examination of their characteristics should be carried out by the municipalities, supported by the MENV. The MENV's water sampling program for individual wells should be offered to the owners of these wells. If necessary, the municipalities could offer these owners financial support. This monitoring should be performed on a regular basis, particularly during critical periods (spring and autumn). In general, the municipalities must also inform all well owners of their responsibility to check the quality of the water in their wells regularly.

◊ The DSPM must have access to the well monitoring data and make the necessary recommendations to owners if an irregular situation occurs.

◊ In view of the recurring risk of contamination of wells located in a flood zone, the municipalities must inform the owners of these wells of the appropriate decontamination measures. All wells located in flood zones entail risk whether or not animal production is involved. The standards set out by the RCES must also be rigorously applied.

Evaluation of the Risks Associated with Air Contamination

Many contaminants are emitted in the air during pig production activities: ammonia, hydrogen sulphide, respirable particles and volatile organic compounds, bacteria, etc. It has been clearly demonstrated among pig production workers that these contaminants have an impact on health. The principal symptoms observed involve irritation and respiratory problems, as well as various general symptoms (headaches, nausea, fatigue, ...).

The impact on the health of neighbouring populations is not as well documented. The few epidemiological studies performed involved larger industrial pig production facilities than those in this study and had certain methodological weaknesses. Nevertheless, these studies do associate an increase in certain symptoms similar to those observed in the workers, in residents living close to wide scale swine operations. Among others, their quality of life is affected in that they are sometimes prevented from opening their windows or going outside, even in fine weather; mood disorders have also been documented.

Although concentrations of contaminants to which populations living around swine operations are exposed are much lower than the levels to which the workers are exposed, we must consider the fact that these populations may include individuals who are more sensitive (the elderly, children, persons who already have health problems) and that people who spend all their time in the area neighbouring these production facilities may be continually exposed to the atmospheric contaminants.

On the basis of studies performed in Quebec and elsewhere, the DSPM analysis determined the proportion of people who could be affected by odours within certain defined perimeters around the production facilities. Among these adjacent residences, three are located within a perimeter where 17 % of the occupants could be affected by odours (Elgin), two residences are located in a zone where 20 % of the occupants could be affected by odours (Godmanchester) and five residences are located in a zone where 14 % of the occupants could be affected by odours (Godmanchester). So, even if the projects respect standards, some people could be affected by odours.

Contrary to production facilities, odours emanating from spreading manure are very ocasional and therefore are less of a problem except for certain residences which are surrounded by the fields where the spreading takes place or for those located down wind. Nevertheless, the producers have made commitments beyond regulatory requirements in regard to spreading liquid manure, such as safer separation distances for the Ormstown facility and low ramp spreading in Elgin and Godmanchester.

The DSPM is of the opinion that the standards introduced to protect public health do not ensure optimum protection for the entire population, particularly due to the separation distances recommended and used and the fixed periods of spreading. In the light of the scientific literature, we believe that the atmospheric contaminants and odours emitted by pig production activities go beyond simple nuisance; they can have harmful effects on health and the concern among the neighbours is justified.

Recommendations

- ◊ In view of the assessment of risks to health associated with odours, the DSPM encourages the implementation of all measures liable to reduce atmospheric emissions from pig production activities, particularly those designed to control emissions from the buildings at the source. Several measures have proved effective and are, in fact, encouraged by the *Fédération des producteurs de porcs du Québec* (FPPQ). Special protection must be assigned to the residences surrounded by fields where spreading will take place.

- ◊ The FPPQ and MAPAQ should support the producers in the implementation of measures designed to reduce the risks of nuisance and harm to the quality of life related to odours. A pilot *Epandage sympathique* project (friendly spreading practices) should be established and supported by the FPPQ in these communities.

Assessment of Psychosocial Impacts

Studies already carried out in municipalities in which the introduction of industrial pig farms caused difficulties indicate that social conflicts can arise due to factors related to the project implementation process such as the perception of a lack of information and transparency and the association of an integrator with such projects. Other factors, inherent to the announcement of any industrial-sized pig production project, have also contributed to creating cohabitation disputes : the apprehension of nuisances, environmental risks, potential

risks to human health and potential socio-economic impacts. According to the DSPM survey of the residents living near the new pig production sites, 50 % fear a deterioration in the quality of air and 47 % fear a deterioration in the quality of water. Under current circumstances, it appears difficult to moderate the social conflict.

The social unacceptability of the projects has created real and perceptible psychosocial impacts on the community and on individuals (citizens, producers, municipal officers). Individuals facing a situation that is beyond their control feel powerless, creating a more or less acute state of psychological distress. The requests for psychosocial assistance and support addressed to the CLSC Huntingdon confirm this. This state of psychological distress may also be repeated, maintained or increased when the pig production facilities commence operations, particularly among those living close to the facilities or the land where liquid manure will be spread who are more at risk of seeing their quality of life affected. The level of harm and extent of this harm in the community is uncertain, particularly in view of varying degrees of tolerance from one person to another.

RECOMMENDATIONS

The authors of a recent Quebec study on cohabitation in rural environments concluded that the foundation for harmonious cohabitation was inevitably the accountability and involvement of the players within a climate of cooperation. They added that implementing projects for which the opposition is high, generally threatens the social climate of a locality or region. The following recommendations could help to relieve the current social conflict.

- ◊ The municipal players, particularly the RCM Le Haut-St-Laurent, should deploy a strategy designed to create a climate of confidence between the various players, based on principles of transparency and information. For example, this strategy could provide for the formation of a public advisory committee under the guidance of the RCM Le Haut-Saint-Laurent, grouping, among others, representatives of the citizens and pork producers directly involved, the *Comité consultatif agricole*, public health officers (DSPM and Huntingdon CLSC) and representatives from MENV and MAPAQ. This public advisory committee would enable information to be exchanged and solutions to problems sought, thereby relieving certain apprehensions. The establishment of a climate of confidence could help to relieve some of the intense emotions experienced by the people involved in this issue.

- ◊ The Huntingdon CLSC should continue to provide psychosocial support to these communities and increase the promotion of these services.

- ◊ The introduction of a " sentinel " monitoring network, together with the Huntingdon CLSC, could permit cases of psychological distress and developments in the social climate to be documented.

CONCLUSION

In short, we were able to document psychosocial impacts on the community, even before the production facilities were introduced. So it is important that the recommendations affecting this aspect are applied as quickly as possible.

Impacts on health caused by odours are more probable for inhabitants located close to the production buildings. However, for most of the residents, impacts will be transitory since they are mostly associated with spreading activities, which are occasional, and since such spreading is to be carried out using a low ramp in two of the three facilities.

As for the other problems, the risks are more uncertain. However, those concerning the groundwater merit particular attention. Studies have allowed us to identify the principal factors involved in the contamination of groundwater. There is no simple way of determining the risk of groundwater contamination in the present case, without having to carry out additional studies. Thus, the application of a single criterion of minimum separation distance may not be adequate under certain conditions. Although certain characteristics of these projects are protective in regard to the risk of groundwater contamination (for example, restriction of spreading within 300 metres of neighbouring residences in the case of the Ormstown project), other characteristics of the area involved are not (for example, the vulnerability of the soils in certain locations, the distance from wells and other characteristics of the wells). Our analysis allowed us to identify the wells most at risk of contamination on the basis of factors identified in scientific literature. However, other verifications and regular monitoring must be performed to determine the vulnerability of these wells more precisely. It should not be forgotten that once the groundwater has been contaminated, reparatory actions can be difficult and not very effective in the short and medium terms, not to mention being onerous and costly to the citizens affected. Dependency on groundwater should also be considered.

Lastly, in regard to surface water, conformity of the Huntingdon filtration plant to recent RQEP standards should be verified to ensure that the removal of micro-organisms is sufficient during critical periods of thaws and high water levels.

A series of specific recommendations have been proposed for each topic. Other general recommendations which are beyond the responsibility of the RCM Le Haut-St-Laurent are also presented at the end of this document.